JET

OPERATING MANUAL

Program written by Charles Guy & Steve Setzler
Directed by Bruce Artwick

Program Number: A2-JET

TELAHIN

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First Printing
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INTRODUCTION

At SubLOGIC we've been steadily developing a comprehensive system of real-time, three-dimensional display and simulation technologies for microcomputers. Jet is an exciting application of these technologies to a realistic simulation of both the F-16 Fighting Falcon and F-18 Hornet jet fighters. These jets have tremendous power and agility, and each is very easy to fly. Jet includes a free flight mode for practicing aerobatics and precision maneuvering, and two different combat modes to test your skills. We hope Jet will provide you with some of the excitement of flying the real thing.

DOCUMENTATION

This manual visually presents the Jet's instruments, controls, and flying techniques. We recommend that you first glance through the manual to get a general overview of all the program's features. Read the detailed descriptions later.

RUNNING THE JET

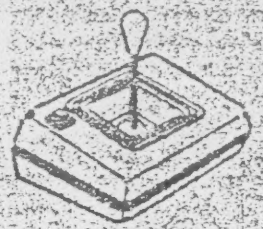
J E T

LOAD UP

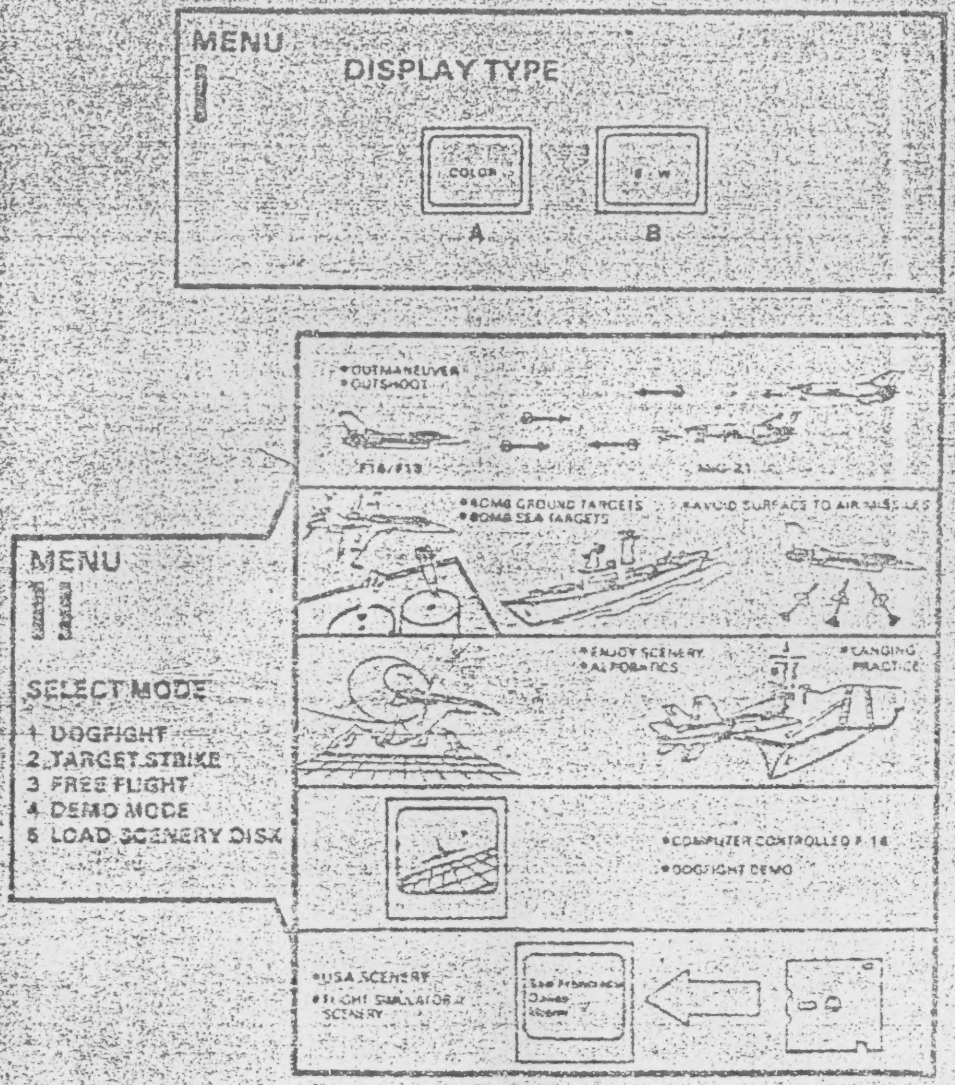
Boot the disk.

Optional

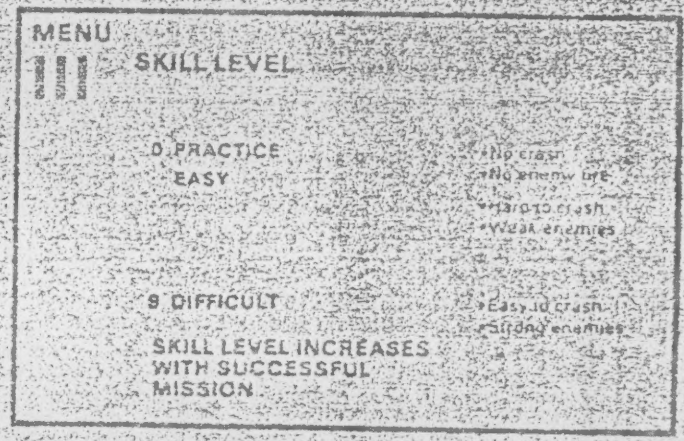
Plug in joystick.

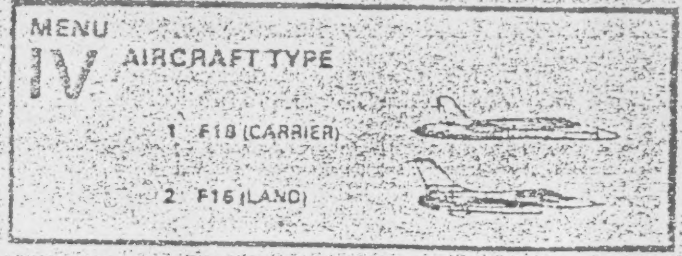


MENU SELECTIONS

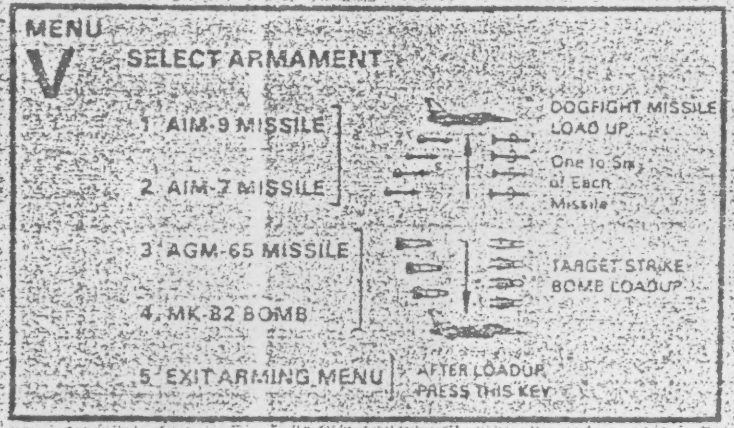


MENU SELECTIONS

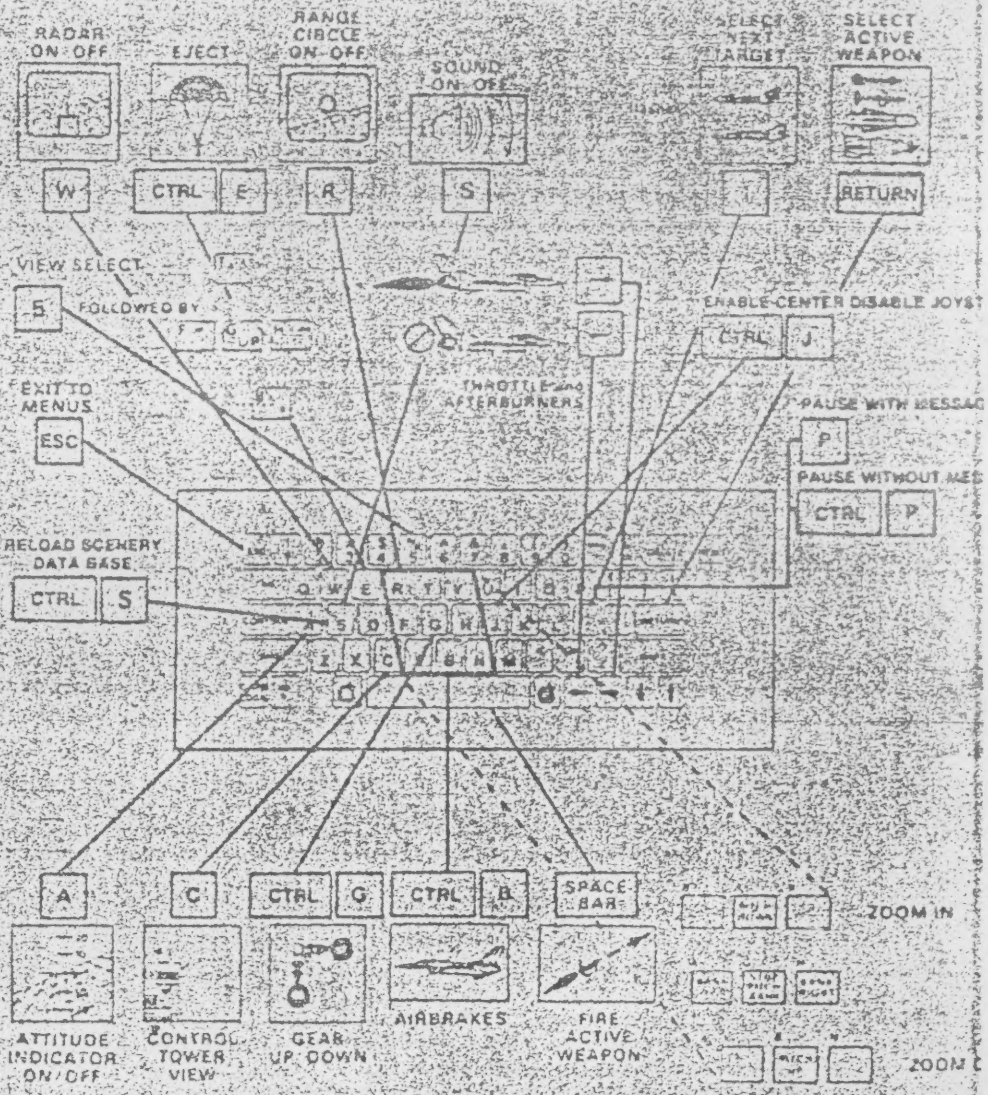




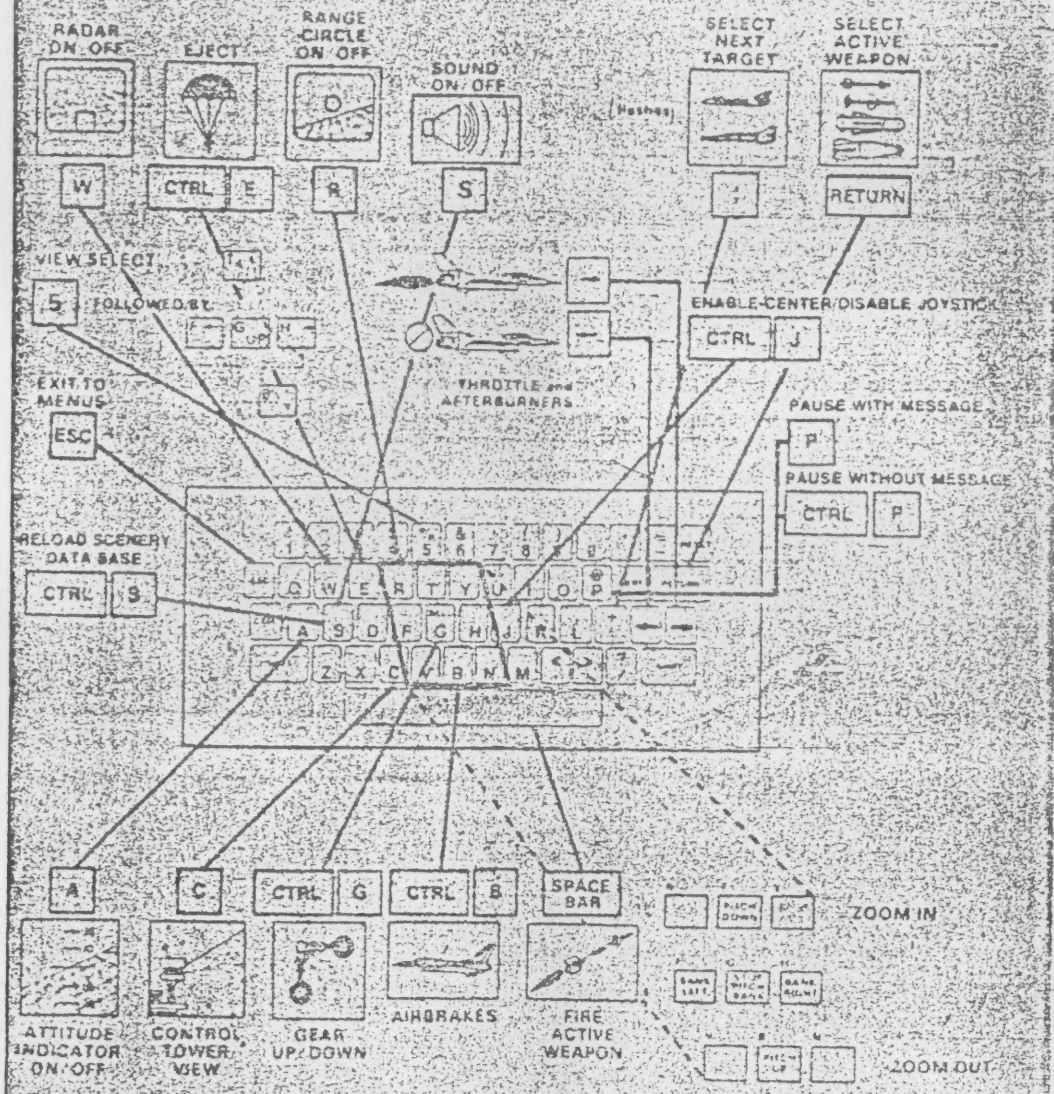
MENU SELECTIONS



APPLE IIe AND IIc KEYBOARD CONTROLS

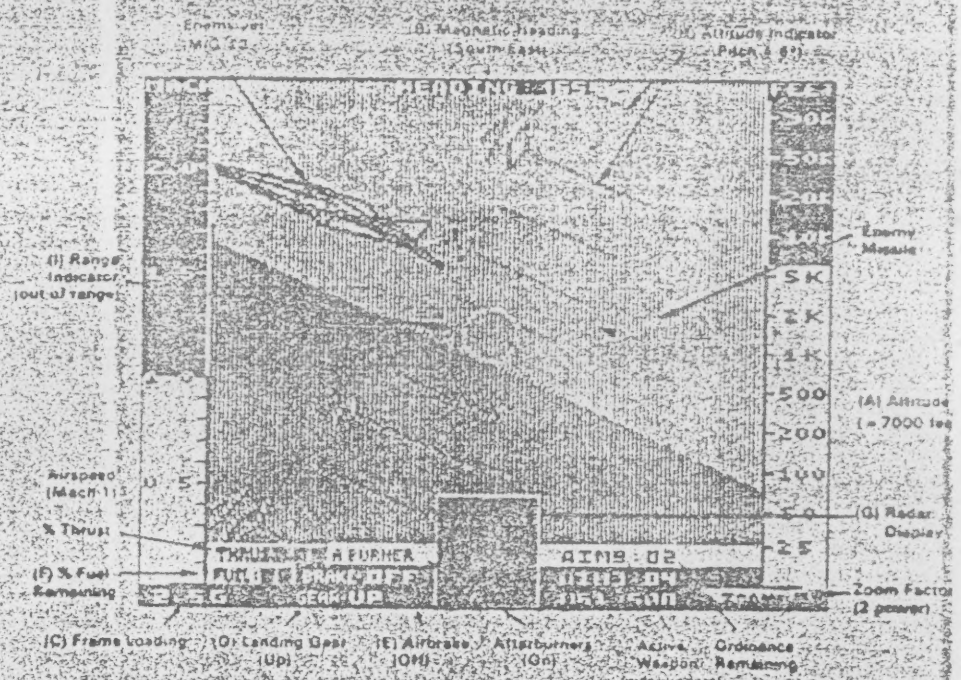


APPLE II AND II PLUS KEYBOARD CONTROLS



DISPLAY AND INSTRUMENTS

SCREEN DISPLAY



OUT-THE-WINDOW VIEW

In flight mode the screen displays a view of the local scenery in front of the jet. If you select the F-16, your initial view will be of the hanger walls and ceiling that surround your aircraft. When flying the F-18 your initial view is off the bow of a Nimitz-class aircraft carrier, where your jet sits ready to be launched from the carrier deck. As you take off and start to fly, the out-the-window display rapidly updates the view based on your position and attitude.

HEADS-UP DISPLAY

A variety of instruments located around the sides of the screen allow for quick readings with minimum outside viewing interference. The vertical bar to the left of the outside view is your **Airspeed Indicator**. This indicates the jet's velocity in Mach number (times the speed of sound). Other instruments located around the outside-view display will now be described in detail. Please refer to the Screen Display illustration to determine instrument location.

A. Altimeter

This vertical bar indicates the jet's altitude above ground level (AGL) in feet. The altimeter's scale is nonlinear and highly accurate even at low altitudes (i.e., landing). The nonlinear scale also alerts you to near-ground approaches when the bar indicator begins to move very rapidly.

B. Heading Indicator

The heading indicator displays the jet's magnetic heading (0...359), where 0 degrees indicates north, 90 degrees is east, 180 degrees is south, and 270 degrees is west.

C. Frame Loading Indicator

Frame loading measures the force exerted on the aircraft perpendicular to the wing surface. This force is measured in G's, where one G equals the force of gravity. If frame loading shows a negative value, the force is applied upward with respect to the wing. This instrument is important because of the human body's limited tolerance to high acceleration. If frame loading exceeds 9 G's, the pilot will black out due to blood

draining from the head. If frame loading drops below -3 G's, the pilot will 'red out' as blood rushes to the head.

D. Gear Status Indicator

This indicator displays the aircraft's landing gear status. Press [CTRL][G] to toggle the landing gear up or down as required.

E. Brake Status Indicator

This indicator displays the status of the jet's airbrake. To toggle the airbrake on or off, press [CTRL][B].

F. Fuel Level Indicator

This indicator displays the amount of fuel remaining as a percentage of total internal fuel capacity. As the throttle is increased, fuel consumption rises proportionally. With afterburners on, fuel consumption is doubled. If your fuel supply is depleted, the engines will flame out and you will have to attempt a *dead stick* landing.

SELECTABLE INSTRUMENTS

Several other instruments may be enabled or disabled at any time. These instruments are optional because they can obscure the out-the-window view and because they slow down overall animation speed.

G. Radar Display

The radar display is superimposed over the outside view. It shows the location of enemy targets, missiles, and your home base with respect to your aircraft. Your own aircraft is displayed as a blue dot in the center of the display. Enemy aircraft or ground targets appear as red dots (your selected target flashes red) and enemy missiles appear white. Your home base will appear as a flashing red/white dot. If your home base is outside normal radar range, the red/white dot will be plotted at the edge of the radar screen in the direction home base is located. The radar display can be turned on and off by pressing the [W] key.

H. Attitude Indicator

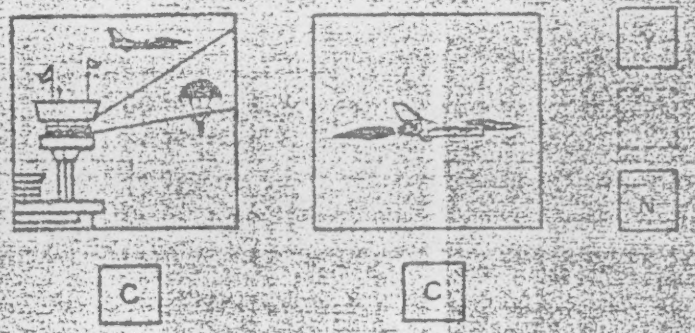
The attitude indicator is toggled on and off with the [A] key. This instrument shows the orientation of your aircraft with respect to the ground. A scale of lines in 20-degree increments both above and below

the horizon indicates the pitch of your aircraft. Single points at the top and bottom of the scale indicate a 90-degree pitch attitude. The aircraft's bank angle is displayed by rotation of the pitch scale. This instrument is very useful when the horizon is not visible outside the window.

L Range Indicator

The range indicator is toggled on and off with the [R] key. This instrument, which appears as a circle in the center of the screen, indicates the distance to your selected target (see **Weapon Systems**). A white circle indicates that the target is out of range. When the target comes into range, the circle turns black and diminishes counterclockwise as you close in. In Target Strike mode, range is computed by measuring the distance to the point on the ground that intersects your aircraft's flight path. This is the target point your guided ordnance will track when released. The range indicator can also be used in conjunction with the attitude indicator to determine precisely which way your aircraft is pointing.

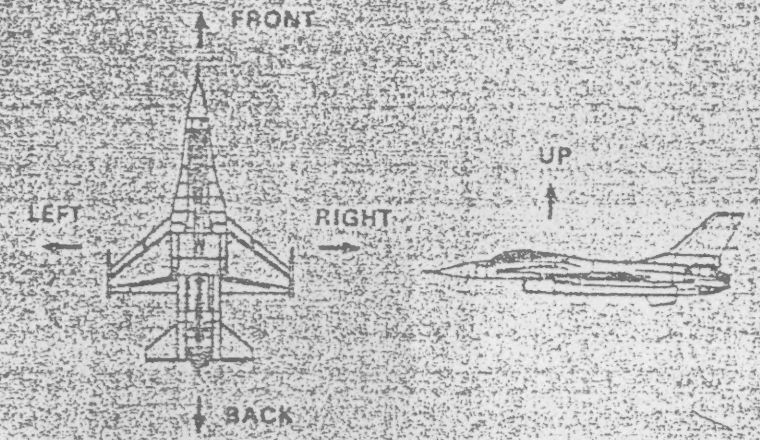
VIEW CONTROL



CONTROL TOWER MODE

In normal flight mode, the out-the-window display is from the cockpit point of view. In control tower mode, you can watch your aircraft from the control tower's point of view. You may zoom in or zoom out (see **View Direction Control**) but the view direction is fixed towards your aircraft. If you eject from the aircraft the view will track you as your parachute opens and you float gently back to earth. Flying the aircraft in this mode is like flying a jet by remote control. Press the [C] key to toggle between cockpit and control tower points of view.

VIEW DIRECTION CONTROL



Keypresses: [5] [F] - Left view
[5] [H] - Right view
[5] [T] - Front view
[5] [B] - Rear view
[5] [G] - Upward view

You can also zoom in and out, like a camera lens, to adjust your angle of view. 2X is the normal viewing angle, but you can zoom in to 8X or out to 1X as desired. The current zoom factor is displayed in the lower right corner of your Heads-Up Display.

[Y] - Zoom in by a factor of 2
[N] - Zoom out by a factor of 2

FLYING THE JET

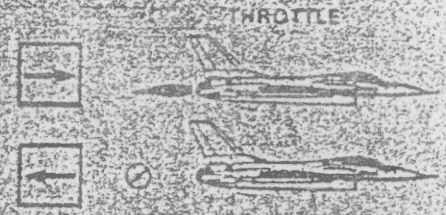
FLYING BY WIRE

Fly by wire refers to a system of aircraft control in which the pilot sends steering commands to a computer which in turn generates actual elevator and aileron movement. All the pilot has to do is point the aircraft in the desired direction and the computer will keep it flying that way. Because the F-16 can generate more pounds of thrust than it weighs, it can accelerate vertically and is considered ballistic. This allows any angle of controlled flight.

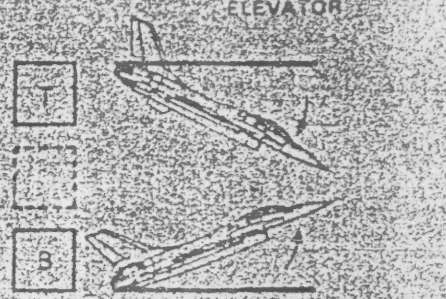
CONTROLS

The Jet has five controls for flight operations.

The Throttle controls engine thrust. To decrease thrust, press the [←] key. To increase thrust, hold down the [→] key for a few seconds and the thrust indicator will climb rapidly. When thrust percentage exceeds 99, the afterburners are activated and a red A.B. indicator is displayed. Press the [←] key once to disable the afterburners.



The Elevator controls the aircraft's pitch attitude. Press [B] or pull back on the joystick to pitch up. If the aircraft has sufficient airspeed, this will bring the nose of the jet up. To pitch the aircraft down, either press [T] or push forward on the joystick.



AILERON

Ailerons control the jet's bank angle. To bank the aircraft left or spin counterclockwise, press [F] or move the joystick to the left. To bank right or spin clockwise, press [H] or push the joystick to the right.

F H

G

STOP PITCH AND BANK

NOTE: When using the keyboard for elevator/aileron control, note that the more times you press a control key the faster you rotate. Pressing the [G] key will stop rotation about both axes.

LANDING GEAR

CTRL G

Landing Gear are used for all ground maneuvering. They are toggled up or down by pressing [CTRL][G]. You may not raise the landing gear while on the ground. When flying, the landing gear should be raised to reduce the drag on your aircraft. This will give you a higher top speed. If you attempt to land with the gear up you will crash.

AIRBRAKES

CTRL B

The Airbrake is used for landings and quick midair deceleration. Use [CTRL][B] to toggle it on and off.

EJECTION

In extreme emergencies (imminent crash or missile hit) it may become necessary to bail out of the aircraft. Press [CTRL][E] to eject from the jet.

CTRL E

* You can see the aircraft fly out from underneath you.
* Use control tower view to watch yourself drift to the ground.

SAMPLE FLIGHT

To being a sample flight, load the Jet and select the appropriate display device. Make your menu selections as follows:

Game Mode	[3] for Free Flight
Skill Level	[0] for Practice Mode
Aircraft Type	[2] for F-16

Now, you should see the flight mode display, including the out-the-window view and instruments. Turn the attitude indicator on by pressing [A]. This overlays pitch markings on top of your window display. Turn on the range indicator by pressing [R]. This overlays a small white circle in the center of the screen which can be used to indicate the direction the jet is flying.

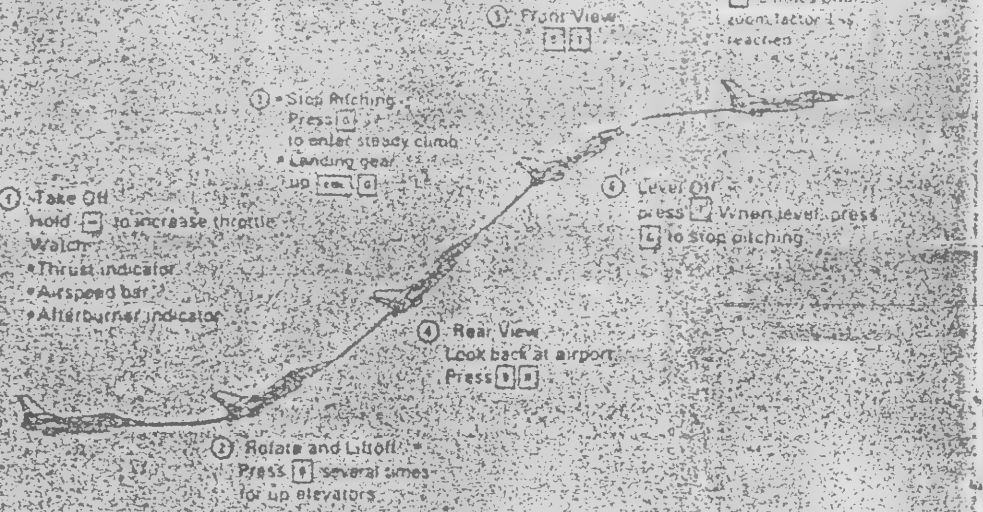
NOTE: You may pause the simulation at any time by pressing the [P] key. Press any key to resume flying. Press [CTRL][P] to pause the simulation without displaying the pause message.

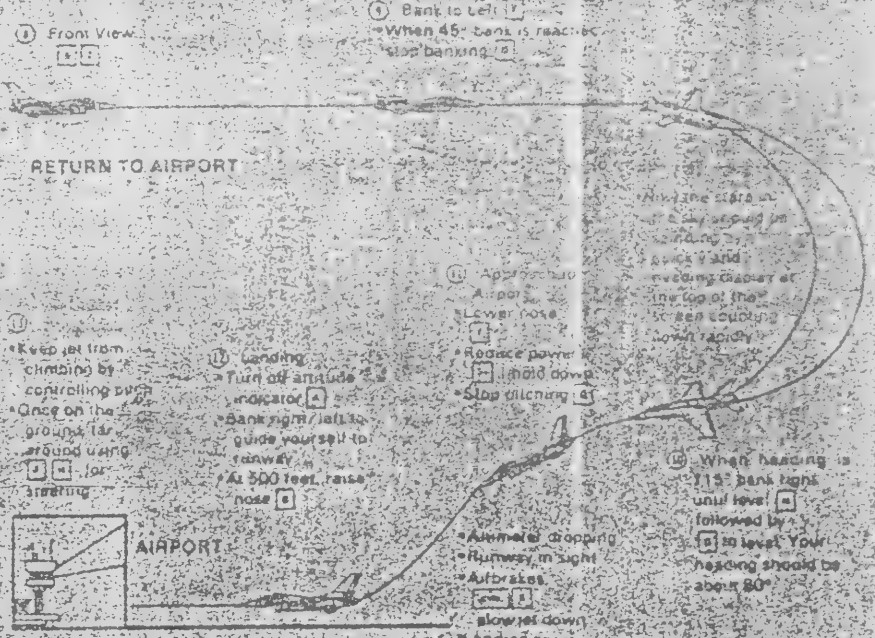
Joystick

Press [CTRL][J] to enable and center the joystick. Once the joystick has been enabled, it may be disabled by pressing [CTRL][J] again.

SAMPLE FLIGHT

Now perform the following steps in sequence, pausing between steps if necessary:





TAKEOFF AND LANDING ON THE CARRIER

If you choose to fly the F-18, you will start out on the deck of a Nimitz-class aircraft carrier. Superimposed over a forward view of the launch catapult is a flashing message:

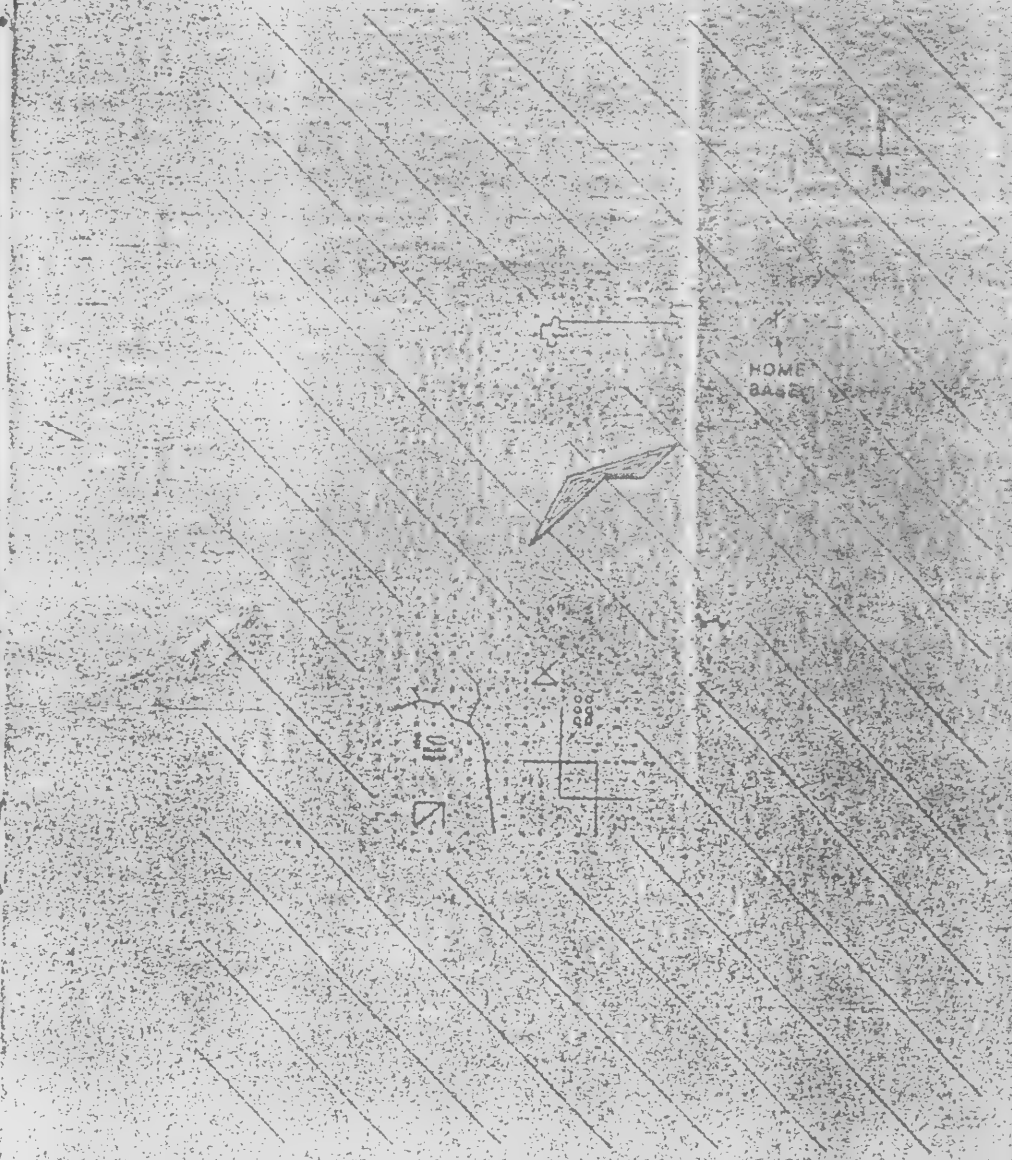
PRESS <L> TO LAUNCH FROM CATAPULT

First increase throttle to full thrust with afterburners on. Then press [L] to launch; the jet will be released and will accelerate rapidly down the deck. As airspeed increases, pull back on the elevator. When the F-18 clears the bow of the carrier, the nose will come up and you will start gaining altitude.

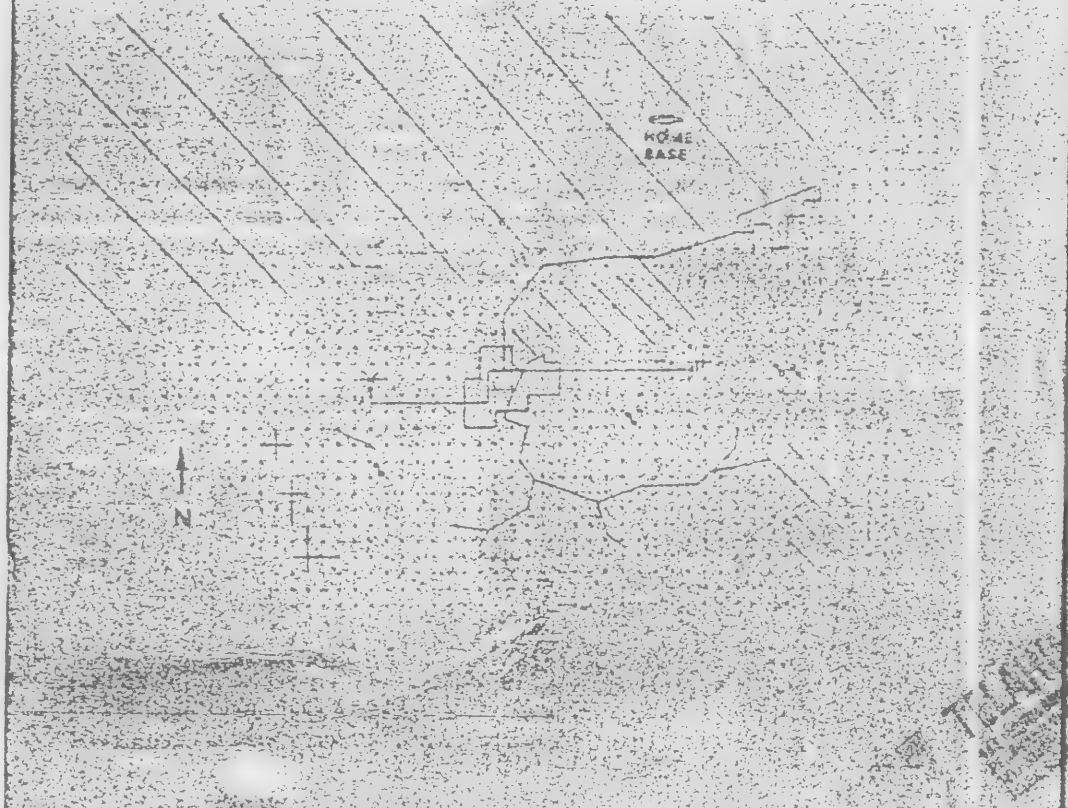
In order to re-arm or refuel the F-18 you must land back on the carrier. To do this you should try to position yourself about 3 miles west and slightly south of the carrier on a heading of 80 degrees. As you approach the Nimitz, the carrier's landing strip should be visible to the left of its superstructure, angled slightly north with respect to the ship's hull. Lower your landing gear and engage the airbrake to reduce airspeed. Now you must try to keep the jet parallel to the landing strip by banking left or right, and aim your nose for the stern of the carrier by pitching up or down. Reduce throttle to about 20% to cut airspeed even more. If you begin losing altitude too soon, increase the throttle. If approach speed is too high, decrease throttle. When the dashed centerline of the landing strip becomes visible, aim for the tripwire to the left of the superstructure. As you pass over the stern of the ship, begin to flare by slowly raising the jet's nose and try to touch down just short of the tripwire. If you catch the tripwire the jet will stop abruptly and you will be returned to the launch catapult (in Free Flight mode) or to the re-arming menu page (for either combat mode).

DATABASE ILLUSTRATIONS

F-16 Free Flight Area

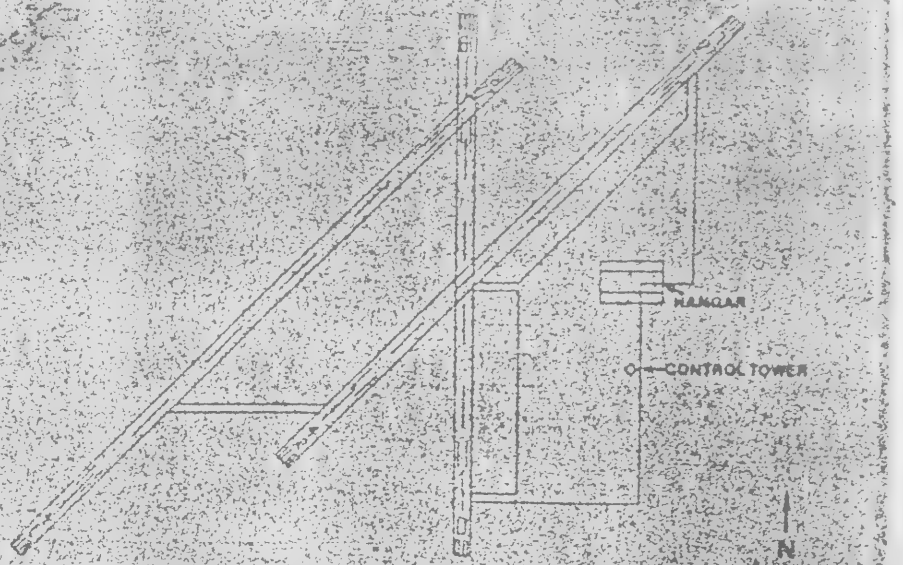


F-18 Free Flight Area



Nimitz-Class Aircraft Carrier
(F-18 Home Base)

F-16 Home Base



WEAPON SYSTEMS

ORDNANCE

In either combat mode, once you've selected a skill level the arming menu then appears as:

SELECT ARMAMENT:

<1> AIM-9 MISSILE 160 LBS X 0
<2> AIM-7 MISSILE 500 LBS X 0
<3> AGM-65 MISSILE 460 LBS X 0
<4> MK-82 BOMB 500 LBS X 0
<5> EXIT ARMING MENU

For the F-16 the following weight data appears below the menu:

F-16 EMPTY 14000 LBS
INTERNAL FUEL 3700 LBS
TOTAL WEIGHT 17700 LBS

Corresponding figures are displayed for the F-18 when that jet is selected.

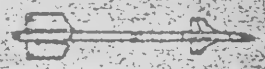
Choose your weapons by pressing the appropriate number key. Each time you make a selection the number to the right of that weapon is incremented by one and your total weight is increased accordingly. If you select more than 6 of one weapon, that weapon's counter is reset to zero.

Press [5] to exit the arming menu after you've finished selecting your weapons. Note that the combined weight of the selected weapons affect the performance and flight characteristics of your jet. As you burn fuel and fire weapons, your weight decreases and the jet becomes more maneuverable. When flying the F-16 you can return to the arming menu at any time by landing and steering the jet into the hanger at your home base. If you are flying the F-18 you can return to the arming menu by

catching the tripwire on the carrier deck's landing strip. After re-arming the F-18 you will be replaced on the launch catapult.

Dogfight Armament

AIM-9 SIDE WINDER



- Short range—5 miles
- Heat seeking, light weight
- Accurate
- Good for close combat

AIM-7 SPARROW

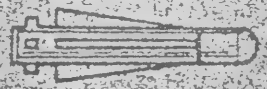
- Medium range—25 miles
- Radar homing
- Disadvantage—high weight

M 61 MACHINE GUN

- 500 rounds loaded when arming menu entered
- Can be used against MiGs
- 20mm cannon

Target Strike Armament

AGM-65 MAVERICK

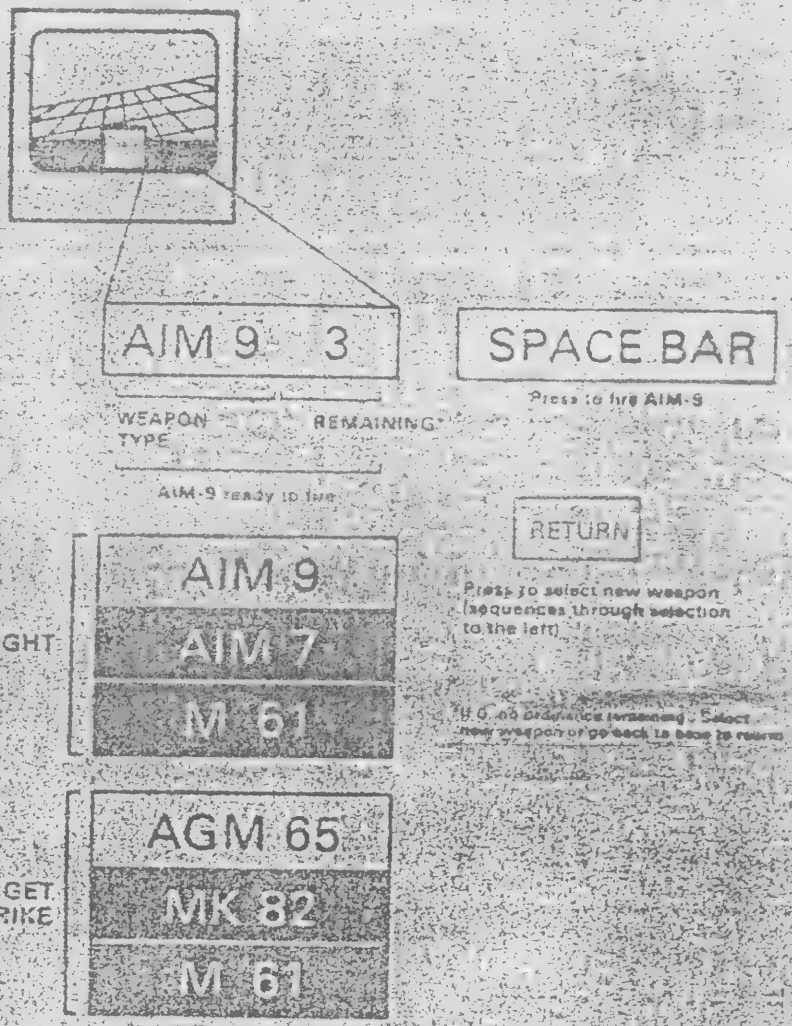


- Air-to-ground operation
- Medium range—14 miles
- Optically guided
- Accurate
- Small warhead—small hit radius

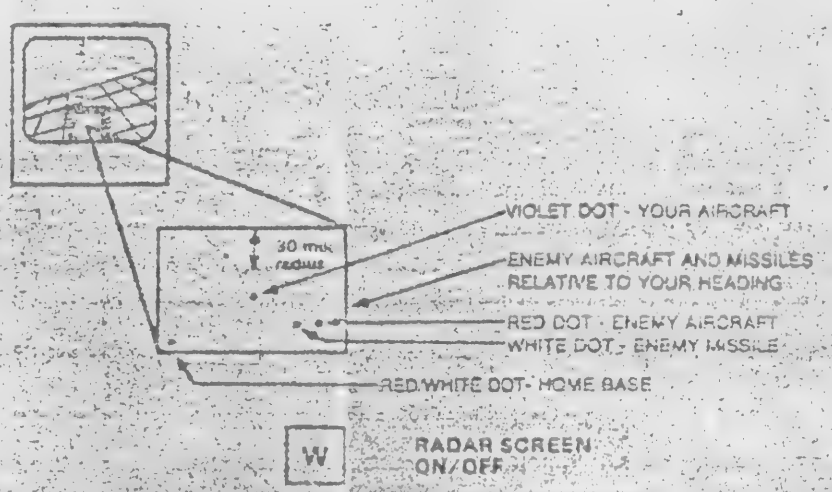
MK-82 SMART BOMB

- Bomb, No propulsion
- Tracks a point on the ground
- Limited accuracy
- Large warhead—large hit radius

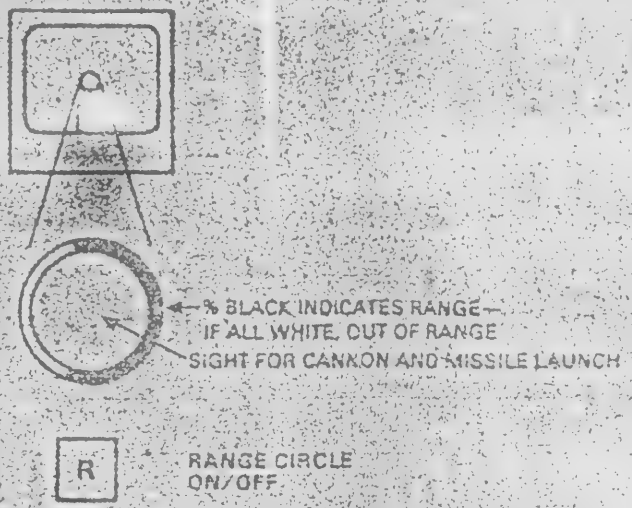
WEAPONS INDICATOR, SELECTOR, AND FIRE CONTROL



RADAR SCREEN



RANGE CIRCLE



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THE DOGFIGHT GAME

OBJECT AND RULES

Dogfight is an intense three-dimensional combat scenario that pits you against Soviet MiG-21 and MiG-23 fighter aircraft. They are equipped with Atoll air-to-air missiles,while you can select from a variable arsenal of AIM 9 (Sidewinder) missiles and/or AIM-7 (Sparrow) missiles along with your 20mm Vulcan cannon. Your mission is to engage and shoot down all enemy aircraft at the skill level you've selected, then return to home base for refueling and re-arming as required. If your mission has been a success, a new wave of enemy aircraft will then appear at the next higher level.

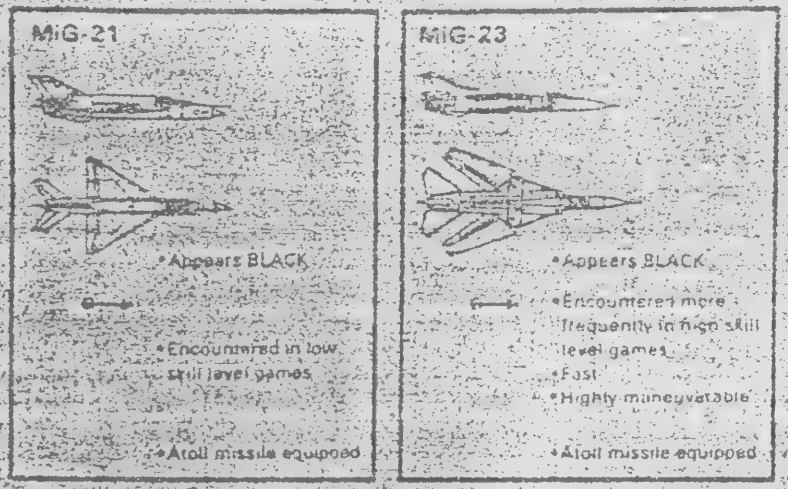
For each successful enemy hit that you score, a token marker appears on the fuselage of your jet. Your score can be viewed out the rear window as the number of tokens lining the right side of your aircraft. If your score exceeds nine, tens-digit tokens are marked along the left side of the fuselage. Shoot down all enemy aircraft before returning to base and a two-point bonus will be added to your score.

A warning beeper will sound if an enemy missile comes within the danger threshold of your aircraft. If you're hit by an Atoll missile, the screen will flash red and orange and the jet will spin out of control. You have seconds to eject before your aircraft explodes and the game is over. If you eject in time you will float safely back to earth, where you will be recovered and given a new jet to fly into combat. Once you get shot down three times, you are grounded and the game is over.

ENEMY AIRCRAFT

At the start of each mission, the enemy aircraft will come at you from the south. You will encounter two different types of enemy jets: the MiG-21 and the MiG-23. These aircraft utilize the same flight equations as your jet, but since they weigh more and have less thrust, they are less maneuverable. The skill level you select will determine the type and

number of aircraft you must shoot down. During a dogfight the MiG's will track you and fire their Atoll air-to-air missiles. Missiles also track your jet, and will detonate their warheads if they get within the hit radius.



To shoot down an enemy aircraft you must first select one as your target. The currently targeted aircraft flashes out your window and on the radar display. Press the [;] key and your onboard tracking computer will automatically sequence to the next target. Since there can only be a maximum of t[illegible] enemies in your airspace at any time, you can cycle to the desired target with a maximum of two keystrokes.

Once you've selected a target you can fire the active weapon. Press the [RETURN] key to cycle through your available weapon systems and choose the one you'd like to use. Press the [SPACE BAR] to fire that weapon. Air-to-air missiles will automatically track the target and detonate if they get within the hit radius. A rising tone from your onboard computer will indicate that the MiG has been hit. The MiG will flash, spin out of control (leaving a trail of flak in its wake), and finally explode.

After shooting down all opponents, or if you run out of weapons and ammunition, you will have to return to home base. Any remaining MiG's will chase you until you enter the safe zone surrounding your base. You can then land, re-arm, and continue combat.

THE TARGET STRIKE GAME

OBJECT AND RULES

Your mission in the Target Strike game is to seek out and destroy all enemy ground targets. When flying the F-16, targets will be randomly selected from the local area airstrips, fuel depots, factories, and missile silos. In F-18 mode, your targets are Soviet Kynda-class cruisers randomly placed in the sea to the south of your aircraft carrier. Each target will be designated by a flashing red point. Your ordnance can include both AGM-65 air-to-ground missiles and MK-82 smart bombs. Press [RETURN] to cycle through your available weapons systems and choose the one you'd like to use.

Turning on your range indicator automatically activates the ground targeting computer. As you fly, the range indicator will show the distance from your jet to the point on the ground that intersects your current flight path. If this distance is greater than the range of your selected weapon, the range circle will show all white. When you come within range, position the desired homing point at the center of the range circle and press the [SPACE BAR]. The weapon will be released and will track that point to the ground. If it impacts within the target's hit radius, the target will explode and a shock wave will spread from the impact point.

For each successful enemy target hit, a token marker appears on the fuselage of your jet. Your score can be viewed out the rear window as the number of tokens lining the right side of your aircraft. If your score exceed nine, tens-digit tokens are marked along the left side of the fuselage. Destroy all enemy targets before returning to base and a two-point bonus will be added to your score.

SURFACE-TO-AIR MISSILES

Enemy SAM launchers are only capable of detecting your presence within the conical airspace directly above them. If you pass within this

airspace they will track your jet and launch their missiles. Because of this you should fly as low as possible when nearing your target. Should an enemy missile come within the danger threshold of your aircraft, a warning beeper will sound. If you are hit with a surface-to-air missile, the screen will flash red and orange and the jet will spin out of control. You have seconds to eject before your aircraft explodes and the game is over. If you eject in time you will float safely back to earth, where you will be recovered and given a new jet to continue the mission. Once you get shot down three times, you are grounded and the game is over.

GAME TIPS AND STRATEGIES

THE DOGFIGHT GAME

When playing the Dogfight game, it's important to have the zoom factor set appropriately. At greater distances, a higher zoom factor (4X - 8X) will greatly facilitate accurate weapons fire. During close-in fighting the lowest zoom factor (1X) will increase your field of view and ease target acquisition and tracking. Viewing the battle from the control tower can help determine enemy aircraft altitude. You may want to get into the habit of scanning several viewing directions during a dogfight to give yourself a better overall view of your environment.

THE TARGET STRIKE GAME

As in the Dogfight game, high zoom factors increase the accuracy of weapons fire in the Target Strike game. When firing air-to-ground weapons it's important to remember that aiming errors are magnified at shallow pitch angles. Approaching the target from steeper pitch angles will allow you to deviate slightly from the target and still impact the ground near it. However, this will also place you in greater danger of being detected by the SAM launchers.

AVOIDING MISSILES

Should you detect an approaching enemy missile (from your view out the window or on the radar screen display), there are two ways to increase your chances for survival. You can try to evade the missile, but this will be difficult because of its high speed and quick turning radius. However, the missile will run out of thrust very quickly and will lose speed rapidly once it begins to coast. Tracking imperfections can also cause the missile to miss you. Another way to increase your chance of avoiding a missile is to fly at right angles to its flight path. This keeps it turning, wasting its

energy and degrading its homing accuracy. If all else fails, you can eject, but this will forfeit one of the three aircraft you are allowed each game.

LOADING SCENERY DISKS

SubLOGIC offers a set of Scenery Disks that allow you to fly over "real world" landscapes covering the entire continental United States. To load a Scenery Disk into the jet program, select game mode [5] from the startup menu. A screen display will prompt you to:

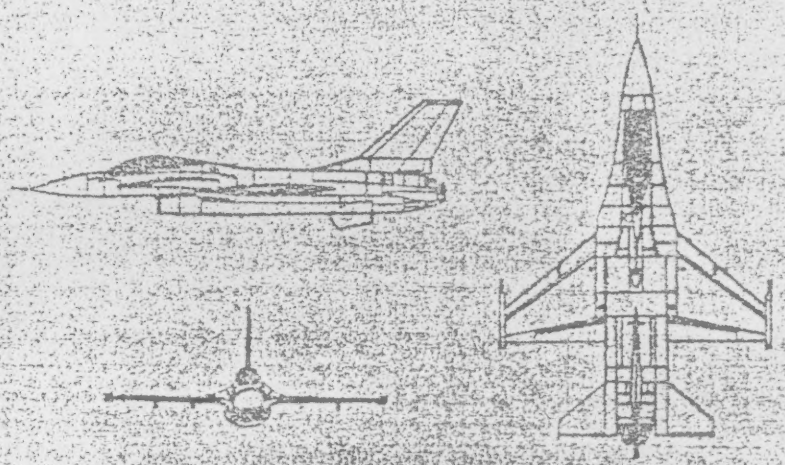
ENTER STARTING LOCATION:

NORTH = 00000
EAST = 00000

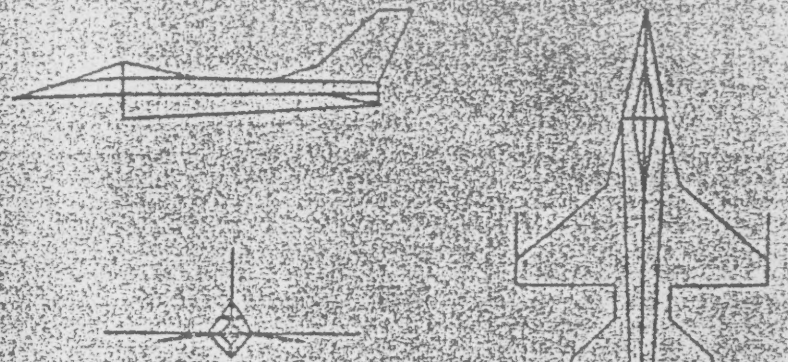
First insert the Scenery Disk into Drive A. Then check that disk's maps and documentation to determine the coordinates of the airport you'd like to start from. Enter the North coordinate and press [RETURN] if correct. If you make a mistake you can back up by pressing the [<--] key. Then enter the East coordinate and press [RETURN] again. The scenery will load into memory and you will continue with normal menu selections. You may select the F-18 for day flight, or the F-16 for night flight. Note that if you own a copy of Flight Simulator II you may use it as a Scenery Disk by following the same procedure.

NOTE: Press [CTRL][S] to load a new Scenery Disk when crossing a scenery database boundary.

AIRCRAFT TECHNICAL DATA

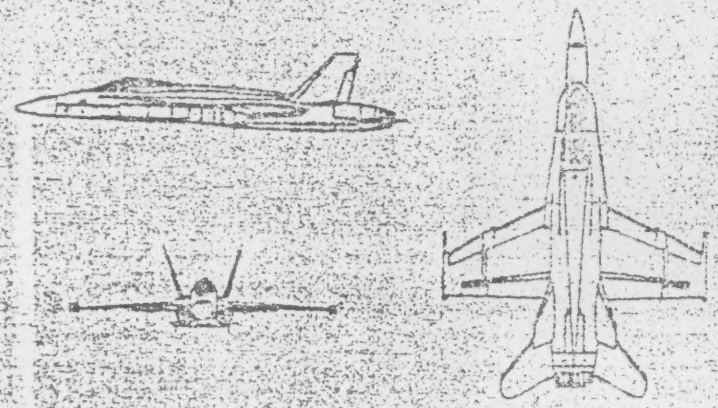


Aircraft:	F-16	Empty weight	14000 lbs
		Maximum Weight	33000 lbs
Wing Span	31 ft	Maximum Thrust	23800 lbs
Length	47 ft	Maximum Speed	1320 mph

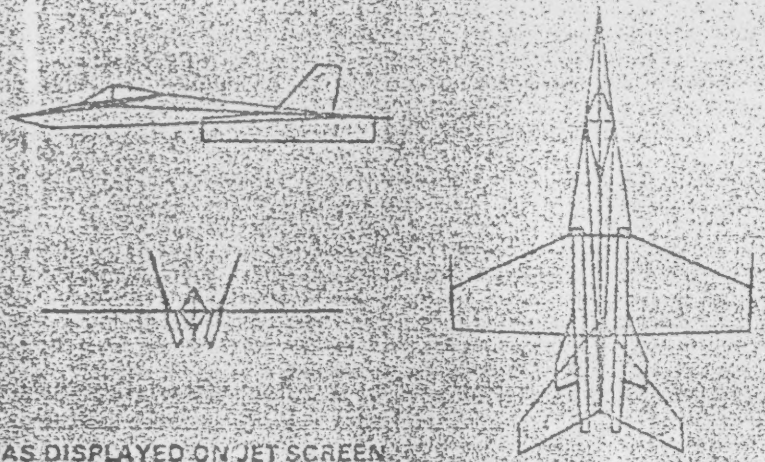


AS DISPLAYED ON JET SCREEN

AIRCRAFT TECHNICAL DATA

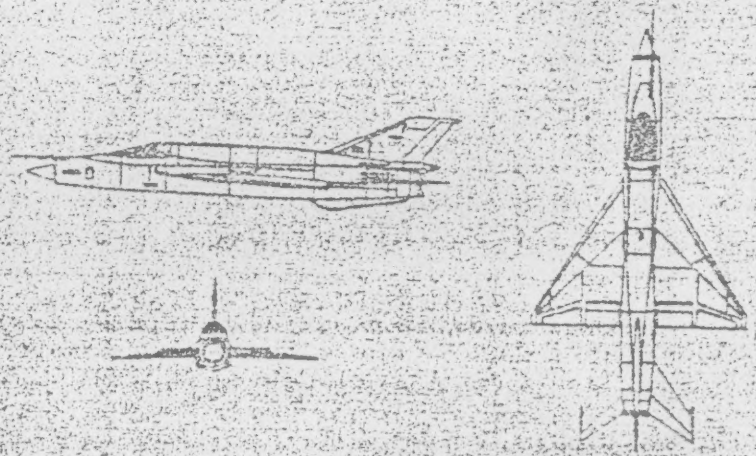


Aircraft:	F-16	Empty Weight	20000 lbs
		Maximum Weight	50000 lbs
Wing Span	37 ft	Maximum Thrust	16000 lbs x 2
Length	56 ft	Maximum Speed	1190 mph

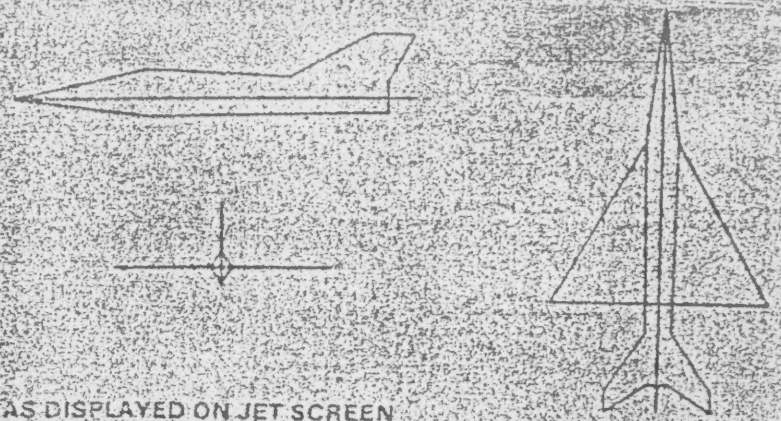


AS DISPLAYED ON JET SCREEN

AIRCRAFT TECHNICAL DATA

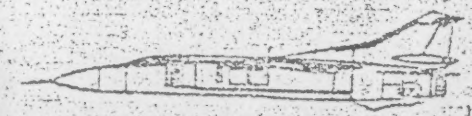


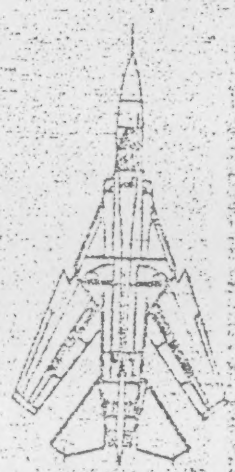
Aircraft:	MiG-21	Empty Weight	n/a
		Maximum Weight	20000 lbs
Wing Span	23 ft	Maximum Thrust	14500 lbs
Length	51 ft	Maximum Speed	1385 mph



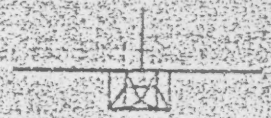
AS DISPLAYED ON JET SCREEN

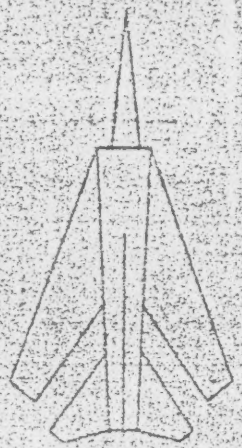
AIRCRAFT TECHNICAL DATA





Aircraft:	MiG-23	Empty Weight	22000 lbs
		Maximum Weight	37000 lbs
Wing Span	26–46 ft (variable-sweep)	Maximum Thrust	25000 lbs
Length	55 ft	Maximum Speed	1520 mph





AS DISPLAYED ON JET SCREEN